INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS

PURPOSE OF THE TABLE: • To provide a summary of the variables and approaches used to calculate radiation cancer risks • To show the EPC used in the radiation cancer risk calculations • To document the radiation risk calculation approach used to calculate radiation cancer risks • To show, based on the documented risk calculation approach, the intake and cancer slope factors • To present the result of the calculation for each Exposure Route/Pathway for each COPC • To provide the total radiation cancer risks for each Exposure Route/Pathway for the Scenario Timeframe, and Receptor presented in this table • To provide the total radiation cancer risks for each Exposure Point for the Scenario Timeframe and Receptor in this table • To provide the total radiation cancer risks across all media for the Scenario Timeframe and Receptor in this table	***Radiation can be evaluated two ways: 1) Calculate cancer risks. The evaluation method used needs to be documented in the Planning Tables 2) Compare radiation doses to standards (i.e., EPA NESHAPS or MCLs or DOE/NRC cleanup standards).*** ***Table 8 is used to show the variables and results when using the first method. The Dose Assessment Worksheet can be used to calculate doses which can be compared to radiological dose standards.***
INFORMATION DOCUMENTED: • The approach for calculating the radiation cancer risk for each COPC for each Exposure Route/Pathway • The values used for EPC, intake and cancer slope factor for each COPC for each Exposure Route • The cancer risk value for each COPC for each Exposure Route/Pathway • Total cancer risk values by Exposure Route, Exposure Point, and across all media for the Scenario Timeframe and Receptor presented in this table	
TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS: • Complete one copy of Table 8 for each unique combination of the following three fields that will be quantitatively evaluated (Scenario Timeframe, Receptor Population, and Receptor Age). • Enter each combination of these three fields in the Summary Box in the upper left corner of the table. • Number each table uniquely, beginning with 8.1 and ending with 8.n where "n" represents the total number of combinations of the three key fields. • Table 8.1.RME through 8.n.RME should be completed for RME cancer risk calculations.	***It is possible that some tables may contain the same data associated with different descriptions in the Summary Box in the upper left corner.*** ***Separate tables may be necessary to ensure transparency in data presentation. Replication of information is readily accomplished using spreadsheet software.*** ***Consult the EPA risk assessor for alternatives (e.g., footnotes) to preparing multiple tables with the same data.***

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)

GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE: • All table entries, with the exception of risk calculation approach, intake, and cancer risk are presented on tables preceding Table 8. • With the exception of modeled intakes, the intake value is the result of calculations performed using parameters and equations presented in Table 4 and concentrations presented in Table 3. • The total cancer risk for each Exposure Route is to be summed and indicated in the Exposure Route Total row. This value represents the cancer risk of the various Exposure Routes across each Exposure Pathway designated in the table. • The total cancer risk for Each Exposure Point is to be summed and presented in the row labeled Exposure Point Total. • The total cancer risk for all media is to be summed and presented in the box labeled "Total of Receptor Risks Across All Media". This value represents the total radiation cancer risk to the receptor for the timeframe designated in the table.	
HOW TO COMPLETE/INTERPRET THE TABLE	
SUMMARY BOX IN UPPER LEFT CORNER	
Row 1 - Scenario Timeframe	
Definition: • The time period (current and/or future) being considered for the exposure pathway.	
Instructions: • Choose from the picklist to the right.	***Current*** ***Future*** ***Current/Future*** ***Not Documented***
Row 2 - Receptor Population	
Definition: • The exposed individual relative to the Exposure Pathway considered.	***For example, a resident (receptor population) who drinks contaminated groundwater.***

Instructions: • Choose from the picklist to the right.	***Resident*** ***Industrial Worker*** ***Commercial Worker*** ***Construction Worker*** ***Other Worker*** ***Golfer*** ***Jogger*** ***Fisher*** ***Hunter*** ***Fisher/Hunter*** ***Swimmer*** ***Other Recreational Person*** ***Child at School/Daycare/ Playground*** ***Trespasser/Visitor*** ***Farmer*** ***Gardener*** ***Gatherer*** ***Other***
Row 3 - Receptor Age	
Definition: • The description of the exposed individual, as defined by the EPA Region or dictated by the site.	***For example, an adult (Receptor Age) resident (Receptor Population) who drinks contaminated groundwater.***
Instructions: • Choose from the picklist to the right.	***Child*** ***Adult*** ***Adolescents (teens)*** ***Pre-Adolescents*** ***Not Documented*** ***Child/Adult*** ***Geriatric*** ***Sensitive*** ***Infant*** ***Toddler*** ***Pregnant*** ***Other***
BODY OF THE TABLE	
Column 1 - Medium	
Definition: • The substance (e.g., air, water, soil) that is a potential source of contaminants in the Exposure Medium. (The Medium will sometimes equal the Exposure Medium.) Usually, the Medium is that targeted for possible remediation.	

Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Surface Soil*** ***Subsurface Soil*** ***Other***
Column 2 - Exposure Medium	
Definition: • The contaminated environmental medium to which an individual may be exposed. Includes the transfer of contaminants from one Medium to another. ***For example:*** ***1) Contaminants in Groundwater (the Medium) remain in Groundwater (the Exposure Medium) and are available for exposure to receptors.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and are available for exposure to receptors.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and are available for exposure to receptors.***	
Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Plant Tissue*** ***Animal Tissue*** ***Fish Tissue*** ***Spring Water*** ***Surface Soil*** ***Subsurface Soil*** ***Particulates*** ***Vapors*** ***Other***

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)

Column 3 - Exposure Point	
Definition: • An exact location of potential contact between a person and a chemical or radionuclide within an Exposure Medium. ***For example:*** ***1) Contaminants are in Groundwater (the Medium and the Exposure Medium) and exposure to Aquifer 1 - Tap Water (the Exposure Point) is evaluated.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and exposure to Aquifer 1 - Water Vapors at Showerhead (the Exposure Point) is evaluated.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.***	
Instructions: • Provide the information as text in the Table.	***Exposure Point should be defined in the same way as was done in Planning Table 1.***
Column 4 - Exposure Route	
Definition: • The way a chemical or radionuclide comes in contact with a person (e.g., by ingestion, inhalation, dermal contact).	
Instructions: • Enter the Exposure Route considered from the picklist to the right.	***Inhalation*** ***Ingestion*** ***Combined (i.e., Inhalation and Ingestion)*** ***Dermal*** ***Not Documented*** ***External (Radiation)***
Column 5 - Radionuclide of Potential Concern	
Definition: • Radionuclides that are potentially site-related, with data of sufficient quality, that have been retained for quantitative analysis as a result of the screening documented in Table 2.	
Instructions: • Enter the radionuclides of potential concern selected from the COPC screening.	***Table 2 documents COPC screening.***
Column 6 - EPC Value	

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)

Definition: • The EPC, based on either a statistical derivation of measured data or modeled data, that represents an estimate of the chemical or radionuclide concentration available from a particular Medium or route of exposure.	***The EPC value may be developed from a statistical derivation of measured data or from modeled data. Typically, the EPC units are expressed as activity per mass such as pCi/gram.***
Instructions: • Enter the EPC value for each COPC. • If an EPC other than from Table 3 is used, indicate it with a footnote that includes a reference to supporting information that will show how the data were modeled in the risk assessment.	***Table 3 documents EPC calculations.***
Column 7 - EPC Units	
Definition: • The units associated with the EPC value.	
Instructions: • Enter the units for the EPC values.	***The units may vary depending on the medium.***
Column 8 - Risk Calculation Approach	
Definition: • The approach used for calculating radiation cancer risks.	***Consult the EPA risk assessor or National guidance for the appropriate risk calculation approach. US EPA RAGS Part A and RESRAD are examples of risk calculation approaches.***
Instructions: • Enter the radiation risk calculation approach used for each COPC.	
Column 9 - Cancer Risk Calculations - Intake/Activity Value	
Definition: • Intake is a measure of exposure expressed in units of activity such as pCi.	***Refers to the intake using the parameters and equations/calculations, and/or models presented in Table 4.***
Instructions: • Enter the result of the intake calculations/modeling performed.	***The intake calculations and/or models are documented in Table 4.***
Column 10 - Cancer Risk Calculations - Intake/Activity Units	
Definition: • The units for intake/activity for each COPC and Exposure Route.	
Instructions: • Enter the units for the intake/activity for each COPC which corresponds to each Exposure Route.	

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)

Column 11 - Cancer Risk Calculations - CSF Value	
Definitions: • A cancer slope factor (CSF) is an age-averaged lifetime excess cancer incidence rate per unit intake (or unit exposure for external exposure pathways). Ingestion and inhalation slope factors are central estimates in a linear model of the age-averaged, lifetime attributable radiation cancer incidence (fatal and nonfatal cancer) risk per unity of activity inhaled or ingested, expressed as risk/picocurie (pCi). External exposure slope factors are central estimates of the lifetime attributable radiation cancer incidence risk for each year of exposure to external radiation from photon-emitting radio nuclides distributed uniformly in a thick layer of soil, and are expressed as risk/yr per pCi/gram of soil.	***Slope factors presented in Table 6.4 for each radionuclide are the same as those presented here.***
Instructions: • Enter the CSF for each COPC which corresponds to each Exposure Route.	***The cancer slope factors for each COPC are presented in Table 6.4.***
Column 12 - Cancer Risk Calculations - CSF Units	
Definition: • The units associated with the cancer slope factor value.	
Instructions: • Enter the cancer slope factor units for each COPC for each Exposure Route.	***Consult the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 13 - Cancer Risk Calculations - Cancer Risk	
Definition: • The result of the cancer risk calculation for each COPC for each exposure route and pathway. Cancer risk is the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to a potential carcinogen.	
Instructions: • Enter the cancer risk calculation for each COPC. • Sum the cancer risk results for each Exposure Route in the Exposure Route Total row. • Sum the cancer risk results for each Exposure Point in the Exposure Point Total row. • Sum the total radiation cancer risk results for all media in the bottom right-hand corner box labeled "Total of Receptor Risks Across All Media".	***The sum of all Exposure Routes represents the total cancer risk for an Exposure Pathway.*** ***The sum of all Exposure Pathways represent the total cancer risk for a medium.*** ***The sum of all media represents the "Total of Receptor Risks Across All Media".***

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)